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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,684	02/03/2004	Christopher P. Ausschnitt	FIS920030423US1	4817
29505	7590	07/22/2005	EXAMINER	
DELIO & PETERSON, LLC 121 WHITNEY AVENUE NEW HAVEN, CT 06510			GUTIERREZ, KEVIN C	
			ART UNIT	PAPER NUMBER
			2851	

DATE MAILED: 07/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A

Office Action Summary	Application No.	Applicant(s)	
	10/771,684	AUSSCHNITT, CHRISTOPHER P.	
	Examiner	Art Unit	
	Kevin Gutierrez	2851	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on February 3, 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☒ Claim(s) 7 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>February 3, 2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 7 is objected to because of the following informalities:
 - a. Page 29, claim 7 - "... as measured at or near the top and bottom of the thickness of the resist layer." The underlined text renders the limitation as unclear. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Mieher et al (US 2003/0048458).

Regarding claim 1, Mieher et al teaches

- "correlating the dimensions of a first set of control patterns printed in a lithographic resist layer ([0008], lines 3-4), measured at two or more locations on or within each pattern that correspond to different optimum focus settings ([0009], lines

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5-8)), to the dose and focus settings of the pattern imaging system to produce dependencies ([0009], lines 8-10);

- measuring the dimensions on subsequent sets of control patterns printed in a lithographic resist layer at two or more locations on or within each pattern, of which a minimum of two locations corresponding to different optimum focus settings match those measured in the first set ([0008], lines 6-8); and

- determining the effective dose and defocus values associated with forming the subsequent sets of control patterns by comparing the dimensions at the matching locations with the correlated dependencies ([0008], lines 9-13)."

Regarding claim 2, Mieher et al teaches "wherein the locations of the different optimum focus settings on or within a pattern correspond to different heights on a profile of the pattern in the resist layer ([0039], lines 20-22)."

Regarding claim 3, Mieher et al teaches "wherein one of the heights comprises a reference height on the profile of the pattern at or near the bottom of the thickness of the resist layer ([0039], lines 12-13, where the reference height is the given height)."

Regarding claim 4, Mieher et al teaches "wherein the set of control patterns is designed so that the correlated dependencies of its measured dimensions to dose and focus are decoupled from one another ([0034], lines 1-3 and [0035], lines 29-30, where shape parameters can be a function of process parameters with various dependencies)."

Regarding claim 5, Mieher et al teaches “further including determining the dimensions of the subsequent set of control patterns at all measured and unmeasured locations for which the correlated dependencies have been determined by substitution of the effective dose and defocus values in the correlated dependencies ([0056], lines 9-12).”

Regarding claim 6, Mieher et al teaches “wherein each of the control patterns has an isolated feature with a pitch greater than twice a width of an individual or repeating feature in a measurement direction ([0097], lines 4-5, where a grating designed as for a pitch more than twice the value of the line width).”

Regarding claim 7, Mieher et al teaches “wherein the measured dimensions of the first and subsequent sets of control patterns comprise widths of the printed control pattern features as measured at or near the top and bottom of the thickness of the resist layer ([0031], line 15, where there is subsequent lithographic printing and ([0038], lines 22-24 and [0041], lines 11-12 and [0056], where same multiple printed structures are measured via scatterometry to obtain shape parameters).”

Regarding claim 9, Mieher et al teaches “wherein the dimensions of the first set of control patterns are measured in a calibration process ([0038], lines 12-13 and 22-24), and the dimensions of the subsequent set of control patterns are measured in a production process ([0006], lines 2-3, where critical dimension of a pattern is measured during production).”

Regarding claim 10, Mieher et al teaches “wherein the correlated dependencies are created using a pre-determined parametric model, and determine optimum dose

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and focus settings for the pattern imaging system ([0033], line 14-15, where the dependencies of shape and process parameters are described in Bossung Plots).”

Regarding claims 11 and 17, Mieher et al teaches “wherein the dimensions of the subsequent sets of control patterns widths are converted to deviations of effective exposure dose and defocus ([0035], lines 13-17, where dependency functions are converted to process parameter function), which are then used to adjust exposure dose and focus settings in the lithographic pattern imaging and processing system ([0039], lines 20-22).”

Regarding claim 12, Mieher et al teaches

- “further including correlating the dimensions of a first set of monitor patterns printed in a lithographic resist layer ([0056], lines 11-13), measured at one or more locations on or within each monitor pattern ([0044], lines 4-7, where measurements are done via scatterometry), to the dose and focus settings of the pattern imaging system to produce dependencies ([0044], lines 16-18 and [0056], lines 5-6, where measurements obtained from scatterometry are utilize for focus=-exposure dependence); and

- determining the dimensions of any monitor patterns printed simultaneously with the subsequent sets of control patterns ([0056], lines 6-7), at all locations for which correlated dependencies of the monitor patterns on dose and defocus have been determined, by substitution of the effective dose and defocus values in the correlated dependencies of the monitor patterns ([0056], lines 9-13).”

Regarding claim 13, Mieher et al teaches

- “process parameters in providing a control pattern having an isolated feature with a pitch greater than twice a width of an individual or repeating feature in measurement direction ([0044], lines 3-4, the pattern has a grating structure);
- exposing a resist layer having a thickness on a calibration substrate with the control pattern design at a plurality of different exposure dose and focus settings ([0038], lines 3-4 and 7-8, where the test wafers are printed with structure using various focus and exposure settings);
- developing the exposed resist layer to produce a calibration resist layer having a plurality of printed control patterns representing different exposure dose and focus settings, each control pattern having at least one printed feature ([0038], lines 13-17);
- for each exposure dose and focus setting, measuring width of the printed calibration control pattern feature at a plurality of different heights along the thickness of the resist layer ([0038], lines 22-24, where shape parameters of printed structures and determined using scatterometry);
- determining optimum dose and focus settings from the measured widths at different heights of the printed calibration control pattern features and creating control pattern model parameters ([0039], lines 20-22);
- printing control patterns at fixed exposure dose and focus settings on a production substrate in a production process ([0040], lines 17-22);

- measuring width of the printed production control pattern features at a plurality of different heights along the thickness of the resist layer ([0041], lines 2-4, where shape parameters are determined by use of provided method);
- comparing the measured widths at different heights of the printed production control pattern features with the control pattern model parameters ([0052], lines 2-4); and
- adjusting imaging and process parameter settings in the production process based on the comparison of the measured widths at different heights of the printed production control pattern features and control pattern model parameters [0057], lines 3-5, where it is regarding the method described in [0056] referencing elements (1-3)).”

Regarding claim 14, “wherein, on the resist layer calibration substrate, the dose range encompasses a dose sufficient to produce a desired pattern dimension and the focus range encompasses optimum focus settings over a substantial portion of the thickness of the resist layer ([0004], lines 1-7, determining optimal focus and exposure settings by determining the best profiles).”

Regarding claims 15 and 19, Mieher et al teaches “wherein the widths of the printed calibration and production control pattern features are measured at or near the top and bottom of the thickness of the resist layer ([0043], lines 11-14), where shape parameters are measured via scatterometry during production (lines 15-16) and calibration ([0042], lines 3-4).”

Regarding claim 18, Mieher et al further teaches the claimed limitations set forth in claim 13 and further teaches

- “exposing and developing the resist layer to print a plurality of calibration monitor patterns and one control pattern representing different exposure dose and focus settings in the resist layer ([0038], lines 5-8, where patterns are printed varying process parameters).”

- “computing the widths of the monitor pattern features at the plurality of heights for which model parameters have been determined ([0036], lines 5-7 and 10-11).”

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 8, 16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mieher et al in view of Okita et al (US 2003/0133088).

Regarding claim 8, Mieher et al teaches “wherein the widths at different heights of the subsequent sets of control pattern features are measured at different locations along the plane of the resist layer [0038], lines 22-25, where shape

parameters can be measured via scatterometry),” but he does not teach the measures being at different times.

However, having the measurements from above at different times is routine in the art as taught by Okita et al ([0121], lines 6-8, where specified shot areas are subjected to measurement). Thus, it would have been obvious to one ordinary skilled in the art at the time the invention was made to modify Mieher et al in a matter described above for at least the purpose to obtain a more precise measurement.

Conclusion

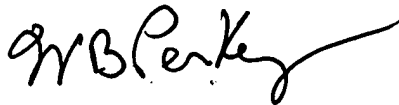
6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Pierrat et al (6,178,360) discloses a method for enhancing process latitude in fabrication device, Grodnensky et al (6,538,753) discloses a method of measurement of variation of a critical dimension utilizing a test mark, and Brown et al (6,689,519) discloses a method for evaluating and controlling a lithography process.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Gutierrez whose telephone number is (571)-272-5922. The examiner can normally be reached on Monday-Friday: 7:30 a.m. - 4:30 p.m..

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Judy Nguyen can be reached on (571)-272-2258. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



William Perkey
Primary Examiner

Kevin Gutierrez
Examiner
Art Unit 2851

July 19, 2005